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Transients in media with near dipole-dipole interatomic interaction

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Abstract

The effect that may be exerted by an interatomic near dipole-dipole interaction upon optical transient processes in dense resonance media is analyzed. The behavior of the macroscopic polarization after a one-pulse excitation of a dense ensemble of two-level atoms is considered. It is shown that the free polarization signal is of oscillatory nature, with the oscillation frequency varying in time and being dependent on the dipole-dipole interaction constant, the intensity and duration of the exciting pulse, and the detuning of its carrier frequency from the resonance. The free polarization signal decay, which depends on the magnitude and sign of the sum of the detuning of the exciting pulse carrier frequency from the resonance and the Lorentz frequency, may obey either a power or an exponential law. The signal decay rate is determined not only by the inhomogeneous broadening, but also by the ratio of the above parameters. The peculiarities of echo-responses under one- or two-pulse excitation conditions are studied.

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Keywords

Dense resonant medium, Dipole-dipole interaction, Free polarization decay, Photon echo